Food and Agriculture Organization of the United Nations

International Labour Organization

Contribution of the forest sector to total employment in national economies

Estimating the number of people employed in the forest sector

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Lippe, R.S. (Thünen Institute)
Schweinle, J. (Thünen Institute)
Cui, S. (Thünen Institute)
Gurbuzer, Y. (FAO)
Katajamäki, W. (ILO)
Villarreal-Fuentes, M. (ILO)
Walter, S. (FAO)

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[1] Funded by the German Federal Ministry of Food and Agriculture through the German Federal Office of Food and Agriculture (BLE) due to a decision of the Deutscher Bundestag, Project number 28I-031-01

Abbreviations and acronyms

FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment of FAO
FTE	full-time equivalent
ICLS	International Conference of Labour Statisticians
ILO	International Labour Organization
INDSTAT	The UNIDO Industrial Statistics Database
ISIC	International Standard Industrial Classification
LFS	Labour Force Survey
NWFP	non-wood forest products
SDGs	Sustainable Development Goals
SMFEs	small and medium forest enterprises
SOFO	State of the World's Forests report of FAO
UNIDO	United Nations Industrial Development Organization

Executive summary

Key messages

- A new wave-based method to measure people employed in the forest sector based on International Labour Organization (ILO) microdata reveals that approximately 33 million people globally were employed for the period 2017–2019, accounting for 1 percent of total employment across all economic activities.
- Informal employment accounts for a significant proportion of forest-related employment, particularly in developing countries.
- Women in the forest sector have a higher probability of having informal jobs than men, and their employment participation in forest-related activities remains low.
- Existing data on forest-related employment underline the importance of the forest sector in people's livelihoods and highlight the need for sustained efforts to ensure the availability of reliable and comparable statistical data on forest-related employment.
- The process should be aligned with the International Conference of Labour Statisticians (ICLS) guidelines and resolutions and conducted in close collaboration with national and global statistical and sectoral stakeholders and authorities, based on social dialogue, including the participation of forest sector employers' and workers' organizations, where applicable.

Introduction

Forests and the forest sector are important sources of employment, livelihoods and incomes for millions across the globe, particularly in rural areas. They provide jobs in a wide range of activities related to sustainable forest management, the provision and production of timber and other wood and non-wood forest products, the protection of forest ecosystems and biodiversity, and safeguarding the benefits of forests. Despite the relevance of forests for employment and income generation, limited quantitative information is currently available on the subject. This lack of data makes it challenging to quantify the number of people employed in the forest sector, and their contribution to global employment.

With respect to the Sustainable Development Goals, forests and the forest sector play a vital role in achieving several targets, including SDG8 on decent work and economic growth, SDG12 on sustainable consumption and production, SDG13 on climate action, and SDG15 on life on land. Employment in the forest sector contributes to rural economies by enhancing opportunities for livelihood improvement and poverty alleviation. Information on total employment is a crucial indicator of the distribution of socio-economic benefits derived from forest sector activities. Understanding the contribution of the forest sector to employment is also important in supporting decision-making and policy processes towards sustainable development. Notwithstanding, estimating forest-related employment involves methodological challenges such as the standardization and comparability of data collected, as well as the availability of reliable and detailed employment statistics. This study employs a new method to fill the gaps of

missing data points in order to provide sound total employment estimates in the forest sector on a global scale.

Terminologies and definitions

In this study, the forest sector encompasses three main subsectors, corresponding to the International Standard Industrial Classification (ISIC) Revision 4 (United Nations, 2008): forestry and logging, ISIC division A02 (forestry); the manufacture of wood and products of wood, except furniture, ISIC division C16 (wood industry); and the manufacture of paper and paper products, ISIC division C17 (paper industry). As the employment data on ILOSTAT from several countries analysed in this study follow the definition of employment adopted by the 13th ICLS,[2] subsistence activities are also considered as employment. Total forest-related employment[3] thus refers to the sum of persons formally and informally directly employed in any subsector as well as the subsistence workforce.

Forest-related employment

Using information from the ILO microdata collection and ILO-modelled employment estimates from 185 countries, the annual average number of persons employed in the forest sector is estimated to be approximately 33 million for the period 2017–2019. This accounts for about 1 percent of total employment across all economic activities. Most of the forest sector workforce is in the manufacture of wood and wood products, representing 58 percent of total forest-related employment. Overall, a declining number of persons are employed in all subsectors of the forest sector. The number of people employed in forest-related activities decreased by around 15 percent from the period 2011–2013 to 2017–2019. Some of the reasons for the decreasing level of forest-related employment include increased productivity through, for example, mechanization and improved forest management practices, and the use of ILO-modelled estimates as the benchmark to fill in the gaps caused by missing data points. Globally, the share of agriculture and manufacturing in total employment has dropped across country income groups (ILO, 2019a). Since this trend is reflected in ILO-modelled estimates for the forest sector, this results in the decrease of estimated forest-related employment during the periods considered.

Informal employment plays a significant role in the forest sector labour market. Estimates based on 56 countries with the available relevant information reveal that 7.7 million persons were informally employed in the period 2017–2019, accounting for 77 percent of total forest-related employment in those countries. The share of informal employment is above 80 percent of the total forest-related employment in most of the countries in Africa and Asia where data are available, 10 percentage points above its overall average in all economic activities, estimated at 70 percent.

For the same period, the data available for 69 countries showed that approximately 3.2 million females were employed in the forest sector. This is equivalent to 23 percent of total forest-related employment in those countries. In general, the proportion of women engaged in the forest workforce in most countries is lower than that of men, with

[2] According to the 19th ICLS, "Persons in employment are defined as all those of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit."

[3] In this study, forest-related employment and employment in the forest sector are used interchangeably, and refers to all three subsectors: forestry, the wood industry and the paper industry.

the share ranging from 4 to 49 percent in the large majority of countries. The analysis further reveals that females are more likely to have informal jobs. A disproportionately higher share of informal female employment is found in Asia and Africa, especially in the subsectors of forestry and logging and the manufacture of wood and wood products.

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1. INTRODUCTION

Forests are indispensable for sustainable development at global and national levels, and as a source of jobs in a range of activities, they can play a key role in contributing to a fair, inclusive and secure future of work with full, productive and freely chosen employment, and decent work for all. Forests provide a wide range of environmental, social, and economic benefits and are an essential source for subsistence. Besides timber, forests are a source of a multitude of other wood and non-wood forest products (NWFP) and ecosystem services. If sourced from sustainably managed forests, forest products can contribute to the transition towards environmentally and socially sustainable economies. While reforestation efforts can provide employment opportunities, sustainable forest management can help mitigate the effects of climate change, given the renewable nature of wood (ILO, 2019b). In addition, new opportunities for decent jobs can be found in the circular bioeconomy.

The forest sector plays a vital role in achieving several Sustainable Development Goals (SDGs), including SDG8 on decent work and economic growth, SDG12 on sustainable consumption and production, SDG13 on climate action, and SDG15 on life on land. Employment in the forest sector contributes to rural economies by enhancing opportunities for livelihood improvement and poverty alleviation. Information on the quantity of employment is a crucial indicator of the distribution of socio-economic benefits derived from labour activities of the forest sector. Understanding the contribution of the forest sector to employment is also important for enabling evidence-based response strategies and supporting decision-making and policy processes towards sustainable development.

Forests and the forest sector are an important source of employment, livelihoods and income for millions, specifically in rural areas across the globe. Some 5.8 billion people use products from trees, forests, woodlands and other ecosystems for food, medicine, income, culture and other purposes (Shackleton and de Vos, 2022). However, quantifying how many people are directly and indirectly employed in the forest sector, and how much they contribute to global employment, is not a straightforward exercise, as only limited quantitative information is currently available on these subjects. Employment is for example covered under FAO's Global Forest Resources Assessment (FAO, 2020a), and efforts have been made by the Collaborative Partnership on Forests (CPF) on "Streamlining forest-related reporting" to provide a harmonized methodological approach regarding indicator 12, "Employment related to the forest sector" as part of the Global Core Set of Forest-related Indicators. A draft discussion paper (FAO, 2020d) on the indicator was presented and endorsed at the 2019 workshop on "Strengthening the Global Core Set of Forest Indicators to support the implementation of the 2030 Agenda and the UN Strategic Plan for Forests 2030".[4]

Quantitative information is even more limited regarding informal and gender-disaggregated employment in the sector. Even though the availability of detailed data has increased significantly in recent years, thanks to ILO efforts to compile and disseminate more and better labour-related data, information remains rather scattered. Informality is not only difficult to assess but also constitutes an impediment to the achievement of decent work. Workers in the informal economy are often vulnerable, lacking social and

[4] For more information on the workshop, see the Co-Chairs Summary Report, available at www.fao.org/3/cb6330en/cb6330en.pdf

economic security. Many forest workers have no formal contract arrangements and lack inadequate personal protection and training; logging operations are particularly prone to both fatal and non-fatal accidents (ILO, 2019c; Yeshanew, 2018). In developing countries especially, women are involved in a wide range of informal forest-related activities (ILO, 2019c), with firewood collection often being the most prominent. A better understanding of informal and subsistence employment can therefore help to overcome decent work deficits where it is most needed in the forest sector (FAO, 2018a).

In 2014, the socio-economic benefits from forests and among them employment were specifically addressed by a State of the World's Forests report (SOFO) (FAO, 2014a), coupled with a background paper on the contribution of the forest sector to national economies (FAO, 2014b). In 2010–2011, global formal employment in the forest sector was reported to be 13.2 million people, accounting for 0.4 percent of the total workforce. Within the forest sector, the highest shares of informal employment and subsistence workers were in logging, collection of firewood, charcoal production and collection of NWFP. SOFO 2014 (FAO, 2014a) estimated that at least 41 million people were employed in the informal forest sector between 2010 and 2011, predominantly in less developed countries. For the same period, Li, Mei and Linhares-Juvenal (2019) revealed that the global forest sector employed over 18 million people directly and supported 45.15 million jobs through direct, indirect and induced impacts. FAO (2020c) combined the two numbers (45 million people supported and 41 million people informally employed) to estimate that forests provide more than 86 million jobs and support the livelihoods of many more people. FAO (2020a) estimated that in 2015 total employment in the forestry and logging subsector was estimated at 12.5 million people (full-time equivalent),

Table 1. Estimates of global forest-related employment from earlier studies

SOURCE	YEAR	MEASUREMENT UNIT	ECONOMIC ACTIVITIES INCLUDED	EMPLOYMENT
Poschen (1997) and ILO (2001)	Late 1990s	FTE persons (millions)	The three subsectors of the forest sector, and furniture	47
FAO (2014a)	2010–2011	Employment (millions)	Solid wood products, pulp and paper production and production of roundwood.	13.2
ILO (2018a)	2014	Jobs (millions)	Forestry jobs relying on ecosystem services	16.7
Li, Mei and Linhares-Juvenal (2019)	2011	Persons (millions)	Three subsectors of the forest sector, and wood furniture	18.21
FAO (2020c)	2010–2011	Job (millions)	Jobs provided by forests	86
FAO (2020a)	2015	FTE persons (millions)	Forestry and logging subsector	12.5
Lippe, Cui and Schweinle, J. (2021)	2015	FTE persons (millions)	Forest sector	64

almost 90 percent of whom were in Asia and Africa. ILO, in 2018, estimated the number of forestry jobs relying directly or heavily on ecosystem services in 2014 at 16.7 million (ILO, 2018a). Using the Global Forest Resources Assessment (FRA) 2020 and United Nations Industrial Development Organization (UNIDO) database, a recent study estimated that at least 64 million full-time equivalent (FTE) persons were employed in the forest sector in 2015 (Lippe, Cui and Schweinle, 2021). The differing numbers in these studies (Table 1) result *inter alia* from the differences in data sources used and units applied, the definition of the forest sector, estimation procedures, and the number of countries included in the analysis. Nonetheless, the prior indicative numbers underline the contribution of the forest sector in generating jobs and income, which sheds further light on the importance of quantifying forest-related employment. They also emphasize the need to continue efforts to ensure the availability of reliable and comparable statistical data on forest-related employment.

The uneven implementation of recent labour statistical standards results in poor harmonization of employment measures across countries, and an inaccurate picture of employment in the forest sector as a whole. Although progress has been made, a substantial number of jobs in the forest sector may not be reported in the various statistics provided by national statistical offices and international organizations, such as ILO, FAO and UNIDO, as the focus tends to be always on individuals' primary jobs. Indeed, the number of non-reported jobs probably surpasses the number reported in official statistics (Poschen, 1997). Estimating the number of people employed or engaged in subsistence work in the forest sector has long been a challenge in this research domain.

Structure of the paper

In light of this debate, this technical background paper presents an improved and up-to-date estimation procedure to accurately assess the magnitude of the total employment in the forest sector on a global and regional scale. It looks at employment in the forest sector from a range of different angles and thus provides a comprehensive overview of the figures. It also aims to provide further guidance for improving the viability of harmonized employment statistics in the forest sector, against the backdrop of the Global Core Set of forest-related indicators.

First, the paper highlights the methodological challenges that exist when employment in the forest sector is quantified based on currently available data sources. It points out the commonalities and differences of data sources regarding terminology, definitions, units and country coverage, and explains how such differences affect the quantification of employment. Second, it develops a new methodology to fill the gaps caused by missing data points based on series of reliable and comparable employment statistics. Third, it provides up-to-date estimates about the current extent of total employment on a global and regional scale and describes its development trends over time. Finally, the forest sector's contribution to employment, broken down by nature of job and gender, is further explored on the basis of available and reliable disaggregated employment statistics.

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2. EMPLOYMENT STATISTICS IN THE FOREST SECTOR

Quantification of forest-related employment involves methodological challenges resulting from differences in country coverage of reliable and comparable data, the lack of agreed-on definitions and the sheer variety of input sources. The following sections thus present the terminology and definitions used in this study as well as an overview of the different data sources, and then address some of the challenges around forest-related employment statistics.

2.1 Terminologies and definitions

An analysis of forest-related employment requires clear and consistent definition of the forest sector. As we have seen in this study, the definition of the forest sector encompasses three main subsectors: forestry and logging (forestry), the manufacture of wood and products of wood (the wood industry), and manufacture of paper and paper products (the paper industry). As specified by ISIC Revision 4,[5] the forestry and logging subsector (ISIC division A02) incorporates silviculture, raw wood-producing activities, the extraction and gathering of NWFP, and products that undergo little processing in the forest, such as firewood and charcoal. The wood industry covers the manufacturing of semi-finished wood and products of wood (ISIC division C16). The paper industry (ISIC division C17) refers to the manufacture of pulp, paper and converted paper products. The manufacture of furniture is excluded in the present study as employment data corresponding to ISIC division C31 contains not only products from wooden material but also any material, except stone, concrete and ceramic.

The 19th ICLS Resolution (ILO, 2013a) defines persons in employment as "all those of working age who (…) were engaged in any activity to produce goods or provide services for pay or profit, comprising employed persons at work and not at work due to temporary absence". Nonetheless, for the analysis period,[6] most country data in the ILO microdata still reflect the definition from the 13th ICLS, in which persons engaged in own-use production work and subsistence foodstuff producers are also considered employed – in contrast to the 19th ICLS, where they are measured separately. According to the 13th ICLS definition, persons engaged in forest-related production for their own final use and thus constituting an essential basis for their livelihood are thus included in these employment estimates. However, in this study, the concept of total forest-related employment refers to *the sum of persons in employment with formal and informal jobs existing in any subsector*. The scope of formal and informal employment can be described using the building-block approach, that is, the two dimensions between enterprise- and job-based concepts (ILO, 2013b), presented in Annex 1.

Production units are defined based on legal organizations and other enterprise-related characteristics, consisting of formal and informal sector enterprises, and households. The informal sector is broadly characterized as consisting of units engaged in the production of goods or services, with the primary objective of generating employment and incomes to the persons concerned (ILO 1993a). The informal economy includes economic activities that are, in law or in practice, not covered, or insufficiently covered, by formal arrangements (ILO, 2015), such as national labour legislation, income taxation, social protection, or certain employment benefits (ILO, 2013b). Contrary to the

[5] The ISIC structure of the 4th revision is more detailed than that of Revision 3, making it essential to identify several new industries separately (United Nations, 2008)

[6] The ILO microdata repository used in this study lies in the period 2011–2019.

formal and informal sector concept, where the unit of observation is the production unit, the concept of formal and informal employment refers to jobs as observation units (*ibid*). The notion of employment can be further distinguished into two main categories, namely: employees (wage and salary workers) and the self-employed. The latter group can be further disaggregated into employers, own-account workers, members of producers' cooperatives, and contributing family workers (ILO 1993b).

2.2 Data sources

Reliable and robust employment statistics are vital for measuring the social benefits derived from forest-related economic activities. ILO employment microdata are a comprehensive and renowned data source derived from the systematic international standardization of national Labour Force Surveys (LFS) and similar household surveys. The LFS covers a wide range of labour topics, including informal employment, unpaid forms of work through its core modules (e.g. main current activity, main and second job characteristics, working time in employment) or add-on modules (e.g. volunteer work, occupational qualifications and skills mismatches). For this study, the number of employed persons with formal and informal main jobs disaggregated by gender from ILO microdata was extracted for three main forest subsectors using the ISIC Revision 4 at the two-digit level. For countries where data corresponding to ISIC Revision 4 is unavailable, the previous ISIC Revision has been applied.

ILO employment microdata are recorded using the headcount unit. From the perspective of time series, however, ILO employment microdata are available only for years in which LFS or other similar household surveys have taken place, with the result that information on various data points may be missing in any given single year. The employment estimates in this study were thus derived from an average of three years between 2011 and 2019, resulting in three reference periods[7] – 2011–2013, 2014–2016 and 2017–2019, respectively. The amount of country coverage by subsector in the most recent period is summarized in Table 2.

Table 2. Total number of countries and territories with available employment data for the period 2017–2019

REGION	TOTAL COUNTRIES AND TERRITORIES	FORESTRY AND LOGGING		WOOD INDUSTRY		PAPER INDUSTRY	
		N	COVERAGE (%)	N	COVERAGE (%)	N	COVERAGE (%)
Africa	60	20	33	20	33	6	10
Americas	58	16	28	17	29	15	26
Asia	51	24	47	26	51	21	41
Europe	52	12	23	12	23	12	23
Oceania	32	1	3	0	0	1	3
All	253	73	29	75	30	55	22

Note: N denotes number of countries with employment data by two-digit ISIC, and Coverage (%) denotes the total amount of countries with employment data by two-digit ISIC with respect to the total amount of countries and territories. Regional aggregates are based on the country groupings defined in the United Nations M49 classification.

Source: Calculations based on ILO Harmonized Microdata, https://ilostat.ilo.org (ILO, 2021).

[7] A three-year interval was chosen to keep consistency with the employment data from FRA 2020 for further comparison.

Alternative global forest-related employment databases include FRA and INDSTAT, compiled by FAO and UNIDO, respectively. In the case of FRA, employment data cover employment activities in forests corresponding to ISIC division A02: silviculture, timber logging, extracting and gathering NWFP, and support services for forestry and transportation within the forest. The reported numbers are based on an average value of a three-year period, reported by official national correspondents (FAO, 2018b). For instance, the data for 2015 are derived from the years 2014, 2015 and 2016. The data reported for the most recent year (2015) in the FRA 2020 cover 137 countries and territories, representing 91 percent of the world's forest areas (FAO, 2020a), in which 71 countries reported gender-disaggregated data. Employment figures from FRA 2020 are reported in terms of full-time equivalent (FTE), corresponding to one person working full-time during a given reference period. National correspondents are requested to record the data source and method used. However, challenges in terms of consistency in the methodological approach used per country persist, as full-time equivalent work can vary among countries. Moreover, the numbers reported are drawn from a range of different sources.

UNIDO provides a variety of databases including employment statistics from all industrial sectors. The UNIDO Industrial Statistics Database (INDSTAT4) contains highly disaggregated data about the manufacturing of wood and wood products as well as that of pulp and paper. The INDSTAT4 database also corresponds to ISIC Revision 4. For countries with missing data at the four-digit-level, data at the two-digit level of ISIC Revision 3 from INDSTAT2 can be used instead. To be consistent with the employment statistics in the forestry subsector compiled by FAO, the average value of employment is computed using the same year period: 2014–2016. More than 100 countries report employment statistics for the manufacturing of wood, pulp and paper. In terms of unit, UNIDO advised the reporting countries to provide employment data in the unit of FTE.

2.3 The challenges of compiling employment statistics in the forest sector

Building on the assessment of the listed database, three challenges must be acknowledged: country coverage, the input of employment statistics and the unit of measurement. As described in the previous section, the three data sources report the number of forest-related employed persons using different units. Nevertheless, for assessment purposes, the unit of employment used by data sources must be consistent. Therefore, the ILO employment microdata based on the headcount unit is converted to FTE, using disaggregated data on the number of hours actually worked within an individual's primary job. The present study assumes that 40 working hours per week equals 1 FTE for all countries where microdata is available. The most recent comparable year across three data sources is the period 2014–2016. This aligns with the recommendations of the expert workshop on strengthening the Global Core Set of Forest Indicators (FAO, 2020d).

Country coverage: For the forestry subsector, FRA 2020 has the largest coverage of countries reporting in FTE units. ILO employment microdata cover approximately 23 percent of all countries and territories, representing 36 percent of the global forest areas. This is because countries such as China, Australia and the Democratic Republic of the Congo are not yet covered by the ILO microdata. In the case of the Russian Federation and Canada, detailed employment data are unavailable at the two-digit level of ISIC.

Furthermore, the country coverage of ILO microdata reported in FTE employment is relatively lower than that in the headcount unit (25 percent coverage for the period 2014–2016). This could be due to the fact that the information used to convert the employment figures in headcount unit to FTE based on hours actually worked is missing in some countries.

The distinction in country coverage between data sources results in different total forestry employment estimates. When using ILO microdata and converted to FTE, the total forestry workforce was at 2.9 million FTE during the period 2014–2016, whereas the estimates based on FRA 2020 suggest approximately 12.5 million FTE (Table 3). Using the production statistics of total roundwood removals to validate the FRA employment data, the number of persons in employment and subsistence workers in the forestry subsector is estimated by the WoodForWork project to amount to at least 48 million persons FTE during the same time period (Lippe, Cui and Schweinle, 2021).

Table 3. Country coverage and employment estimates in the forestry and logging subsector, by different data sources for the period 2014–2016

REGION	COUNTRY COVERAGE (%)			SHARE OF FOREST AREA (%)			EMPLOYMENT (THOUSAND FTE)		
	ILO	FRA	WoodForWork	ILO	FRA	WoodForWork	ILO	FRA	WoodForWork
Africa	27	58	83	23	62	98	363	2182	25 233
Americas	19	43	57	67	97	99	553	737	7 641
Asia	33	57	80	34	94	98	1 802	8896	14 044
Europe	23	73	73	4	99	100	145	696	706
Oceania	6	31	31	0	79	99	0	28	345
All	23	54	68	36	91	99	2 864	12539	47 970

Source: Calculations using ILO harmonized microdata, https://ilostat.ilo.org, (ILO, 2021), FRA2020 (FAO, 2020b) and the results from the WoodForWork project (Lippe, Cui and Schweinle, 2021).

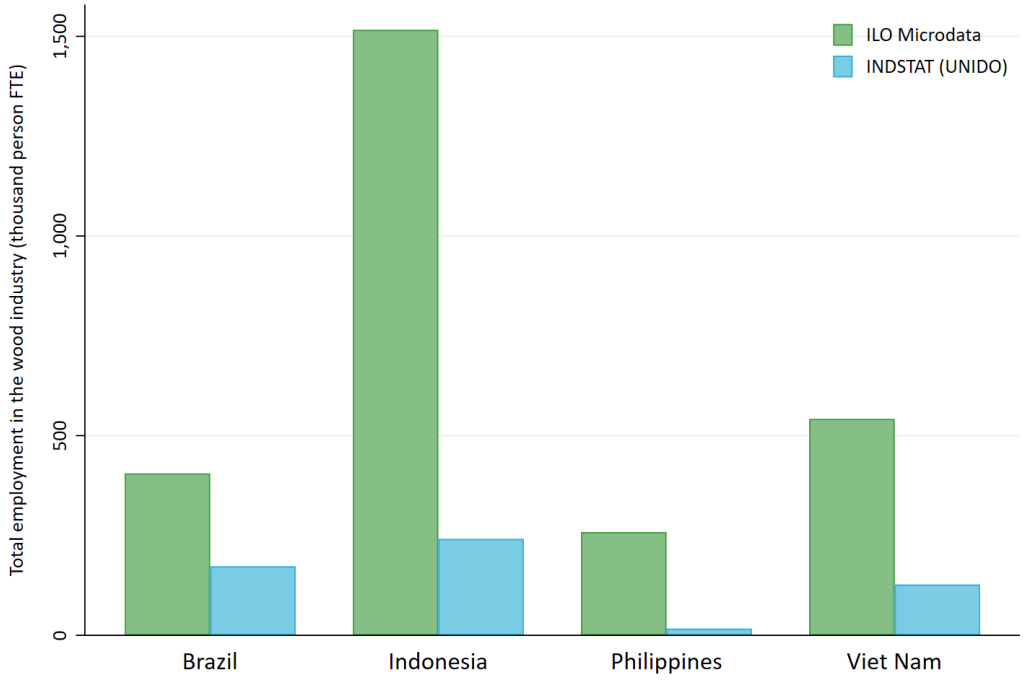
In the case of the wood and paper manufacturing subsectors, the INDSTAT database compiled by UNIDO contains broader coverage on the employment statistics than ILO employment microdata. However, from the unit of measurement in the INDSTAT database, approximately 80 percent of the reported employment data refer to employees. The remainder refers to the number of persons engaged in the respective subsector, which may also include self-employment or family workers. Table 4 provides the total employment numbers in the wood and paper industries,

Table 4. Total employment (thousand FTE) in the wood-based manufacturing subsector, period 2014–2016

REGION	WOOD INDUSTRY		PAPER INDUSTRY	
	ILO MICRODATA	INDSTAT	ILO MICRODATA	INDSTAT
Africa	767.3	164.2	62.9	100.1
Americas	1 059.9	765.9	607.2	719.8
Asia	3 497.9	2 500.8	971.5	2 438.1
Europe	333.7	1 209.0	190.8	796.0
Oceania	0.1	58.9	0.0	22.6
All	5 658.9	4 698.8	1 832.5	4 076.6
Number of reporting countries	60	103	54	100

Source: Calculations using ILO harmonized microdata, https://ilostat.ilo.org, (ILO, 2021) and INDSTAT database (UNIDO, 2020)

Figure 1. Total employment in the wood industry subsector (C16) of selective countries derived from two data sources for the period 2014–2016



Source: own illustrations using ILO harmonized microdata, https://ilostat.ilo.org (ILO, 2021) and INDSTAT database (UNIDO, 2020)

derived from ILO microdata and the INDSTAT database. Apparently, the higher rate of country coverage in the INDSTAT database does not lead to higher total employment estimates, particularly in the case of the wood industry subsector. This is because for countries such as Brazil, Indonesia, Philippines and Viet Nam, employment estimates from ILO Microdata are comparatively higher than those from the INDSTAT database (Figure 1).

Input for constituting a statistical forest-related employment database: As outlined in the previous section, the employment data from ILO microdata, FRA 2020 and UNIDO are derived from different input sources. The main underlying data sources for ILO are the LFS or similar household surveys, which are specifically designed to capture the main labour statistics in alignment with ICLS guidelines. The well-structured microdata processing initiative by ILO has led to quality improvements and enhanced comparability across countries in a transparent and efficient manner (ILO, 2018b). In the case of FRA2020, national correspondents were requested to report forestry employment gender-disaggregated data, where available, for four reference years. While FRA2020 has the largest country coverage, significant challenges in terms of comparability and consistency of input information used for producing employment statistics remain. For example, it is unclear whether every country reports the number of employees in the forestry subsector, or whether they also consider the number of self-employed persons and subsistence workers.

In the case of the wood and paper manufacture subsectors, a similar situation arises (Table 4 and Figure 1). INDSTAT data compiled by UNIDO refer mainly to the number of employees, whereas ILO employment microdata includes the number of self-employed persons. Inputs that constitute both databases draw on different survey sources, which

can have different perspectives and survey approaches. For example, data for Indonesia in the INDSTAT database are based on a survey of registered establishments, which implies that the reported number of employees could also be more related to formal jobs. This confirms that the use of LFS or similar household survey by ILO provides a broader scope, which ultimately reflects the informal and subsistence workforce more accurately.

FTE vs. Headcount: Theoretically, FTE employment is a measure of labour input, whereas the number of persons employed in the headcount unit refers to employment. According to SNA 2008 (United Nations, 2009), "FTE employment is the number of full-time equivalent jobs, defined as the total hours actually worked by all employed person divided by the average number of hours actually worked in full-time jobs". FTE employment is an important economic indicator that can be used to calculate labour productivity, especially when data on hours actually worked are not available. In the forestry subsector, an interchangeable form of employment can occur depending on several factors, such as seasonality and individual living conditions. For instance, a person's primary occupation might be that of a daily wage logger, while the same person might also harvest wood fuel for home consumption (Poschen, 1997). In that sense, measuring employment in the unit of FTE can result, for example, in recording a smaller number of persons employed, due to those people who only spend a part of their time collecting firewood. On the other hand, the employment estimates in the headcount unit can provide a better overview of the social benefits derived from the forests. In addition, employment reported using the unit of FTE must be used with caution, as in the case of forestry-related employment in FTE from the FRA 2020. This is because the use of full-time and part-time units as the basis to constitute FTE labour statistics can vary across countries and regions. One country may consider 40 hours per week as 1 FTE, whereas another country may apply fewer or more reference hours.

3. METHODOLOGICAL APPROACH TO FILL IN DATA GAPS AND RESULTS

Among the three primary data sources described above, only ILO microdata allow for breakdowns of employment statistics in terms of jobs and gender. Moreover, the data are comparable and standardized across countries and regions. The measurement of employment aligns with international guidelines, particularly those adopted by ICLS. Despite this, an overview of global forest-related employment country coverage beyond the current provision is needed. The present study endeavours to fill the gaps of missing forest-related employment data points. The following subsections describe the new developed "wave-based method" used to measure the total number of persons in employment in the forest sector, followed by a look at some of its methodological limitations. The last two sections present the final estimate and trends of the global forest-related employment as a result of the wave-based method.

3.1 The wave-based method

The "wave-based method" used to fill the gaps caused by missing data points involves two major steps, based on the assumption that the distribution of subsectoral forest-related employment and employment of the main economic activities are closely related. The imputation and estimation rely on forest-related employment, ILO microdata and the November 2020 version of the ILO-modelled employment estimates[8] (or 'ILO-modelled estimates'), (ILO, 2017). The wave-based method uses the ILO-modelled estimates in the agriculture and manufacturing as benchmarks for the forestry subsector and wood-based manufactures, respectively.

In the first step, a balanced panel data of countries that reported at least one data point on employment is generated for each forest subsector. A data point in this study refers to the three different periods. Each period covers three-year intervals from 2011 to 2019 (see section 3.2). For the forestry subsector, the missing data point is thus estimated using ILO-modelled estimates in agriculture factored by the country employment coefficient. The country employment coefficient is the share of forestry employment in ILO-modelled estimates in agriculture to the closest available data point. For instance, in the case of country A, forestry employment data in period 3 is missing and is represented by A3 in Table 5. Following the procedure described above, A3 is then calculated using the proportional factor of forestry employment from period 2 (586/39396) multiplied by the modelled estimates for employment in agriculture in period 3 of country A, respectively.

The same procedure is applied to the wood and paper manufacture subsectors. Consequently, a balanced panel employment data has been obtained for the forestry and manufacture of wood subsectors of 96 countries, and for the manufacture of paper and paper products in 70 countries.

The second step is to estimate the forest-related employment figures for countries not covered by the ILO microdata. The procedure assumes that countries in the same geographical domain are likely to be homogeneous in terms of forest-related employment. The balanced panel of forest-related employment data derived from the first step and the ILO-modelled estimates are thus used to generate regional employment coefficients for each subsector and data point. A regional employment coefficient is the weighted

[8] The ILO-modelled estimates provide a complete set of internationally comparable employment statistics for 189 countries, disaggregated by main aggregate economic activities ILO (2017).

Table 5. Examples of estimated employment data for countries with available information for at least one data point

COUNTRY	NUMBER OF EMPLOYED PERSONS (THOUSAND HEADCOUNT)					
	AGRICULTURE (SECTION A)- ILO-MODELLED ESTIMATES			FORESTRY AND LOGGING (DIVISION A02)		
	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3
A	41 220	39 396	37 698	640	586	A3 = 561
B	209 143	203 894	200 342	534	B2 = 521	527

share of forest-related employment in the ILO-modelled estimates for agriculture and manufacturing, as shown in equation 1:

$$Coefficient_{s,region} = \frac{\sum_{c=1}^{n} Employment_{Forest-related}}{\sum_{c=1}^{n} Employment_{Main\ aggregate}} \quad (1)$$

$Coefficient_{s,region}$ is the regional coefficient of subsector *s* (A02, C16 and C17); $Employment_{Forest-related}$ denotes number of employed persons in the forest-related subsector; $Employment_{Main\ aggregate}$ refers to ILO-modelled estimates for agriculture (benchmark for the forestry subsector) and manufacturing (benchmark for wood-based manufacture); and *c* stands for country in the considered region. The number of persons employed for countries missing all data points is thus derived from the ILO-modelled estimates factored by the regional employment coefficient of the subsector in question as presented in equation 2.

$$Employment_{c,s} = ILO\ modelled\ estimates_{c,agriculture\ /\ manufacturing} * Coefficient_{s,region} \quad (2)$$

The imputation of employment figures is applied to all missing countries over the three-year periods considered in the present study.

3.2 Limitations

Using the wave-based method to deal with missing time-series data and countries not covered by the ILO microdata provides a global overview of how many persons are employed in the forest sector. Nonetheless, a number of uncertainties must be flagged up. First, the methods applied to fill data point gaps use the ILO-modelled employment estimates as a benchmark. In that sense, the estimated number of persons in employment for missing data points are "imputations on imputations". This caveat could also affect the accuracy of the estimated number of persons in employment in the forest sector in general.

Second, the forest-related employment figures for several countries are derived solely from ILO-modelled estimates and estimated regional employment coefficients. Having no forest-related employment at any data point could lead to over- or underestimation of global employment in the forest sector. This is true particularly of countries where the forest sector labour market is significant. Further refinement of the wave-based method at the country level is required to offset this uncertainty.

Third, some countries that shared microdata with ILO were already following the employment definition based on 19th ICLS, although the majority still applied the 13th ICLS, in which subsistence workers are included. This could also have an effect on the regional employment coefficients that are used to calculate the number of persons in employment for missing countries in the ILO microdata repository.

Finally, the current estimate of forest-related employment is based on all countries included in ILO-modelled estimates. Nonetheless, some subsectors may not appear in all countries used in the estimating process. The overall number of

forest-related employment could thus be overestimated.

3.3 Total employment in the forest sector

Table 6 presents the number of persons employed in the forest sector in different regions of the world. It covers 185 countries, representing 99 percent of global forest areas. In the period 2017–2019, 33 million persons were employed in the forest sector globally. This equates to 1 percent of total global employment. The number of total forest-related employment dropped by around 15 percent between the periods 2011–2013 and 2017–2019. Reasons that may explain the decreasing level of forest-related employment include increased productivity through for example mechanization and improved forest management practices, and the use of employment ILO-modelled estimates as the benchmark to fill the gaps in missing data points. Globally, the share of agriculture and manufacturing employment in total employment has dropped across country income groups (ILO, 2019a). Since this trend is reflected in ILO-modelled estimates for the forest sector, this results in a decreased estimate of forest-related employment during the considered periods.

Among subsectors, the manufacture of wood and products of wood account for 58 percent of total forest-related employment. Asia holds the largest absolute number of employed persons in all three subsectors. Furthermore, the forestry subsector continues to play an important role in employment contribution, especially in Africa, with a share of 42 percent of total forest-related employment. While still significant, employment in paper industry is lower than the other two subsectors in all regions.

3.4 Trends in forest-related employment

Since the period 2011–2013, the percentage of employment in the forest sector and all its subsectors has declined in relation to total employment of all economic activities. (Figure 2).

The trends observed reveal moderate differences across regions and subsectors.

Table 6. Number of employed persons (thousands) in the forest sector by region for the period 2011–2013 and 2017–2019

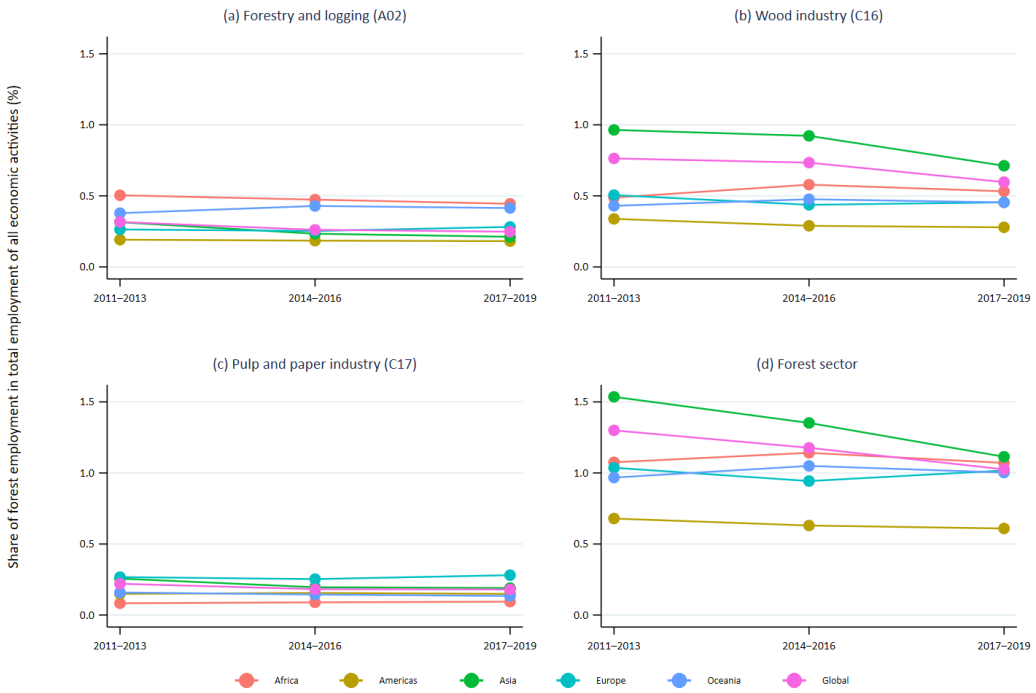
REGION	NO. OF COUNTRIES	FORESTRY AND LOGGING		MANUFACTURE OF WOOD AND WOOD PRODUCTS		PULP AND PAPER MANUFACTURE		TOTAL FOREST SECTOR	
		2011–2013	2017–2019	2011–2013	2017–2019	2011–2013	2017–2019	2011–2013	2017–2019
Africa	54	1 928.3	1 972.7	1 866.2	2 361.4	316.9	418.2	4 111.4	4 752.3
Americas	33	819.5	842.1	1445	1 291.7	637.2	689.4	2 901.7	2 823.2
Asia	48	5 924	4 199.7	18 145	14 104.1	4 828.7	3 759.5	28 897.7	22 063.3
Europe	39	872.2	965.3	1 670.7	1 557.9	882.1	961.6	3 425	3 484.8
Oceania	11	64.6	77.7	73.4	85.2	27.1	25.2	165.1	188.1
Global	185	9 608.6	8 057.5	23 200.3	19 400.3	6 692	5 853.9	39 500.9	33 311.7

Source: own calculations based on ILO microdata and ILO-modelled employment estimates, https://ilostat.ilo.org (ILO, 2021)

Note: These estimates are based on employment data in the forest sector provided by the ILO's microdata repository and employment modelled estimates derived from the agriculture and manufacturing sectors, used to fill the gaps of missing data points and countries without forest-related employment statistics in the repository. Seventy-eight countries reported data related to the forest sector for at least one subsector in the repository. For countries with no available data, estimates are based on regional coefficients and employment figures from the ILO-modelled estimates for the agriculture and manufacturing sectors.

In the forestry subsector, the share of employment slightly decreased for most of the regions, except Europe and America (Figure 2). In the case of the wood industry subsector, a downward trend can be observed in Asia, particularly between 2014 and 2019, as against a slightly upward trend in Europe. Graph "c" of Figure 2 above shows that most regions experienced stagnation in employment share in the pulp and paper industry subsector. Nonetheless, a slight increase of employment in the paper industry subsector for the case of Europe is visible from the second to the third period.

Figure 2 (a-d). Employment trends by region and subsector



Source: Calculations based on ILO microdata and employment modelled estimates, https://ilostat.ilo.org. (ILO, 2021).

Notes: Forest-related employment figures from 185 countries are used to calculate employment share in the total employment of all economic activities (ILO-modelled estimates).

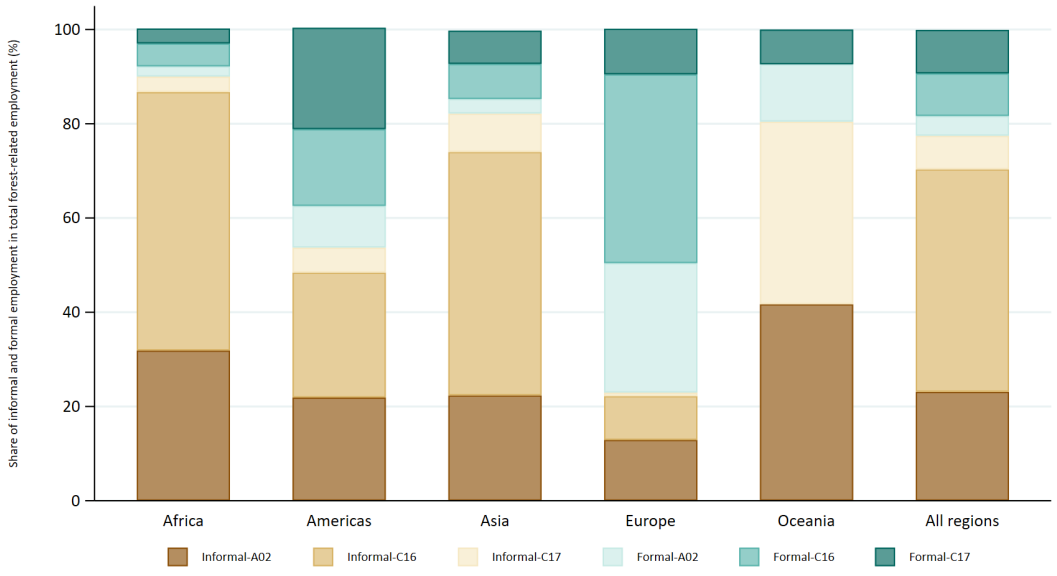
4. DISAGGREGATION OF FOREST-RELATED EMPLOYMENT STATISTICS

The forest sector is characterized by a high degree of informality and substantial numbers of microenterprises and family workers (Arce, 2019). Moreover, women are often involved in a wide range of informal forest-related activities, including low-paid or unpaid conditions, with firewood collection often being the most prominent (ILO, 2019c). Quantifying informal employment and understanding the contribution to the forest sector made by employment of both men and women are essential to supporting decision and policy processes as well as enhancing decent work deficits. However, estimating the number of persons who are informally employed in the forest sector, particularly disaggregated by gender, has continued to pose a challenge, as many workers are invisible and thus not captured in the forest-related employment statistics. The available ILO microdata from some countries – disaggregated by both job and gender – provide an opportunity to further explore the current distribution of formal and informal employment and the subsequent proportion of female employment in the forest sector, as presented in the following sections.

4.1 Formal and informal employment

Analysis of ILO microdata shows that informal employment still plays a significant role in the labour market of the forest sector. Estimates based on 56 countries that reported employment data disaggregated by job reveal that 7.7 million persons were informally employed in the period 2017–2019, accounting for 77 percent of the total forest-related employment in those countries. The

Figure 3. Proportion of formal and informal employment (percentages) in total forest-related employment by region for the period 2017–2019



Source: own calculations based on ILO microdata, https://ilostat.ilo.org (ILO, 2021).

Notes: A02, C16 and C17 refer to the forestry and logging, wood industry and pulp and paper industry subsectors, respectively. The share in this graph is computed based on the number of employed persons with formal or informal jobs, divided by the total forest-related employment in the region. The estimate is based on countries with available employment data, disaggregated by job.

share of employed persons with informal jobs would probably be even higher if disaggregated data about the nature of jobs were available for more countries.

The variation in the proportion of informal employment among regions can be observed from Figure 3. Generally, informal jobs are the main source of employment in the forest sector, especially in developing countries. In Africa, Asia and Oceania, the share of informal employment is above 80 percent of total forest-related employment. In the Americas half of total employment in the forest sector is informal. In Europe, the level of informal employment is lowest, at 23 percent.

In most African countries for which data are available (N = 18), a high share of informal employment can be observed in all subsectors. In Uganda, for example 98 percent of the total forest-related workforce are informally employed. This is largely explained by the fact that over 79 percent of total wood production is devoted to fuelwood and charcoal production. These products are widely utilized in supplying domestic energy needs and to improve individual livelihoods (FAO, 2016). However, for a few countries in Africa data disaggregated by job are unavailable. Consequently, the amount of informal employment in the region is probably higher than the figures reported in this study.

Similar to Africa, informal employment is also prevalent in the Asian forest sector, including countries such as India, Viet Nam and Bangladesh. In India an estimated 73 percent of the forest sector workforce are informally employed. The share is even higher in the case of the wood industry, in which 90 percent of Indian wood industrial workers have informal jobs. The forest-related industry in India is highly diverse, covering a wide range of services and entrepreneurs from individuals working informally to small and medium forest enterprises (SMFEs) with more formal working relationships (Dubey, 2008). In the case of Viet Nam, informality is prevalent in the forestry and wood industry subsectors. The shares of informal employment are above 80 percent of the total employment for both subsectors. The wood processing sector in Viet Nam has experienced considerable growth over the last decade, particularly in wood products such as particle board, flooring and furniture which support employment and livelihoods (Sadanandan Nambiar, 2021). However, most plantation smallholders or woodworking enterprises in Viet Nam still remain informal due to lack of incentives and lack of understanding about the advantages of formalization (EU FLEGT Facility, 2019).

In the Americas, disaggregated employment data are available for 13 countries. Within Brazil, approximately 67 percent of the total forest sector and 52 percent of the wood industry workforce is informal. Brazil belongs to the global top five producers of industrial roundwood, accounting for a total of 142 million m^3 in 2019 (FAO, 2021), and is the third largest wood fuel producer, after China and India, with a production volume of approximately 123 million m^3 (*ibid*). A significant proportion of the Brazilian population continues to use wood fuel for domestic purposes (Gioda, 2019). SMFEs are also predominant in Brazil (May, Gonçalves da Vinha and Macqueen, 2003).

4.2 Women in the forest sector

An estimated 3.2 million females were employed in the forest sector in the 69 countries for which ILO employment microdata were available at least in one subsector during the period 2017- 2019. This is equivalent to 23 percent of the total forest-related employment in those countries. In general, the number of women employed in the forest sector is lower than that of men in most countries, with a participation rate of 4–49 percent

of total forest-related employment. The exceptions include some countries particularly in Africa (e.g. Chad, Mali, Niger) where the share of female employment exceeds the male share. The low proportion of employed women can be partly explained by the nature of forest sector work. Several tasks in logging and wood-based industries typically require intensive physical labour, which can hinder female participation. Female workers are often preferred for less physical tasks, such as the planting of saplings (Ackerknecht, 2010), or in some cases become formally employed in administrative departments (UNECE and FAO, 2020). The low share of female employment in the forest sector workforce could be also related to the fact that not all women engaged in forestry activities are captured by the reported statistics. Women are often involved in informal and subsistence activities, and they are often responsible for meeting household demands for food and fuel, which mostly involve unpaid activities such as fuelwood collection (ILO, 2019c). Another reason may be the sort of under-coverage bias that can occur in labour force or household surveys, in which the sampling and observation units are household and household members, respectively. This kind of non-sampling error affects the available information not only in terms of gender, but also affects every other factor counted in reaching figures for total employment.

In the forestry subsector, the female participation rate is approximately 26 percent of total forestry employment. The countries in which the share of female participation exceeds that of the male workforce are Mali, Togo, Lesotho, Zimbabwe, Burkina Faso and Kenya, in descending order (see figure 4[a-c]). The transparent overlay bars in case of Figure 4a reveal that female employment in these African countries is mostly informal, with above 80 percent of the total roundwood removals being for wood fuel production. In general, countries in sub-Saharan Africa are still excessively dependent on biomass fuels, accounting for 60 percent of the total energy demand, and often produced within the informal economy, such as the collection and trade of fuelwood and charcoal (Sola *et al*., 2019). The fuelwood business continues to make an important contribution to the livelihoods of poor and vulnerable local people. This holds true particularly for women, as fuelwood collection can often be their only source of income.

For the wood manufacturing subsector, the proportion of female workforce in total employment is approximately 21 percent in the 63 countries for which data were available in 2017–2019. Among the regions, Asia boasts the highest share of female workers employed in the wood industry subsector, including high proportions in Viet Nam, India and Bangladesh. The transparent overlay bars in Figure 4b further depict that women in those countries are mostly employed in informal jobs.

In the paper manufacturing subsector, the proportion of employed women is approximately 28 percent of total employment. The region of Asia, based on 17 countries with available disaggregated-gender data, holds the largest proportion of women employed in this subsector, mainly in India and Viet Nam. A similar situation can be observed in the Americas region. For example, the share of female employment in the paper industry subsector in the cases of Mexico and Brazil is about 30 and 35 percent respectively. The transparent overlay bars in Figure 4c also indicate that most of employed women in the mentioned Asian countries are informal.

Overall, disaggregated-gender data indicate that women are still under-represented among the forest-related workforce. Nonetheless, a high proportion of forest-related female employment in some countries reveals a gradual increase

in the involvement of women in forest-related economic activities. In addition, females are likely to have a higher probability of having an informal job, although their employment participation rate is lower than that of males. This is shown by the transparent overlay bars in many countries that cover or even exceed the green bars.

Figure 4(a-c). Share of male and female employment in total employment (%) by subsector for the period 2017–2019

Notes: The blue and green bars refer to the share of male and female employment (in percentages), respectively, in total employment of each subsector for the period 2017–2019. The transparent overlay bars indicate the share of informal male and female employment (in percentages= in the total employment of each subsector, where disaggregated data are available.

Source: own illustrations based on ILO microdata, https://ilostat.ilo.org (ILO, 2021).

5.CONCLUSIONS

Enhancing the availability of reliable and comparable forest-related employment statistics on national and global scales is necessary for enabling evidence-based policy advice and response strategies, and hence plays a key role in efforts towards a sustainable and resilient future in the forest sector. The quality and consistency of employment statistics across countries are crucial for measuring the socio-economic benefits derived from forests and related economic activities. However, the quantification of forest-related employment involves methodological challenges, caused by available data, agreed units of measure, country coverage of reliable information, and sufficient inputs to construct the necessary database. Furthermore, work in the forest sector is characterized by high degrees of informality and seasonality and jobs are often reported as a secondary or tertiary, making it more challenging to capture the full extent of forest-related workforce.

The ILO microdata collection, and especially the ad hoc queries provided for this study, reduces the estimating burden as the source of data are comparable and standardized, with a consistent definition of employment in line with internationally agreed guidelines. The data allow for a wide range of further investigations such as informal employment, women in the forest sector and labour input in terms of hours actually worked. Limited country coverage remains a challenge, however, and good-quality data from a wider range of countries are needed to be able to rely on ILO microdata collection as the sole source of information on forest-related employment. In this respect, complementary data from alternative and reliable sources must be identified.

Since the frequency of LFSs or national household surveys varies between countries, the wave-based method applied in this study is a promising option in dealing with incomplete time series. Nonetheless, the method necessitates further refinement to minimize a number of uncertainties that affect the accuracy of its estimates. The following aspects are recommended to further improve data availability and to ensure and sustain data quality.

- The conducting of a systematic review of available employment data from the ILO microdata in which comparable sector-level data from alternative sector-specific sources should be considered.
- Forest-related employment data at frequent intervals can support the monitoring of employment in the forest sector at national, regional and global scales. Hence, the possibility of using time-series estimations and projections to reduce the data gaps should be explored and carried out in future analyses.
- In-depth analyses and additional research using ILO microdata at the individual level in particular countries where the forest sector is significant would further contribute to data quality verification. For instance, the coherence of labour input with the output of forest products and services should be further examined.
- Headcount unit measurement provides a more comprehensive overview of how many people are employed in the forest sector. Nonetheless, labour input information such as hours actually worked or FTE employment is also required for data verification. Methods to impute missing hours

actually worked are required in this case and should be elaborated.

- The process should be aligned with the ICLS guidelines and resolutions and conducted in close collaboration with national and global statistical and sectoral stakeholders and authorities, based on social dialogue including the participation of forest sector employers' and workers' organizations, where applicable.

Data compilations such as the FRA based on information provided by national correspondents currently contribute to higher country coverage. Nevertheless, due to inconsistencies between data provided by national correspondents, the interpretation and comparability of reported data among and within countries present challenges. Hence, comparable methodology – identifying data sources and converting national figures to comparable international estimates – should be provided to national correspondents to enhance data consistency among reporting countries. The quality assurance process after data compilation should further support data quality improvement.

Long-term cooperation and dialogue among national statistical offices and institutions such as relevant national and international organizations and research institutes, as well as social partners, should be strengthened to fulfil the above recommendations and enable more efficient estimation procedures. Continuing to increase synergies and collaboration between ILO and FAO on employment statistics in forestry is a key issue, including by accelerating action on the development of harmonized methodological approaches to enhance the capacity of countries to collect, analyse and report economic, environmental, social and labour market statistics in forestry. Processes such as this could further enhance and sustain the availability of comparable and reliable forest-related statistics on the global scale. In addition, enhanced efforts are also needed to improve data on other labour-related aspects, such as on accidents and work-related illnesses.

Data availability for this indicator could be improved by the consistent use of the definition of employment given here and its corresponding measurement in line with ICLS recommendations. Other possible actions include conducting a systematic review of data availability in ILOSTAT, considering comparable sector-level data from other sector-specific sources; carrying out further work on the potential for using time-series estimates and projections to reduce data gaps; commissioning additional research to contribute to data quality verification; and increasing support for countries in collecting, compiling and disseminating harmonized data related to this indicator in line with the SDG framework.

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Annex 1

Building-block approach to describe formal and informal employment

Formal employment refers to (i) employees who are affiliated with social security schemes or entitled to certain employment benefits (block F3 and F5); and (ii) employers in a unit of production that is considered formal (block F1, F2 and F4). Informal employment, on the other hand, is the total number of informal jobs, whether carried out in formal or informal enterprises, or households. This comprises "(i) own-account workers and employers employed in their own informal sector enterprise (block I3 and I4); (ii) all contributing family workers (block I1 and I5); (iii) employees who are not subjected to legal protection or social security (block I2, I6 and I10); (iv) members of informal producer cooperatives (block I8), and (v) own-account workers producing goods exclusively for their own end use, under the premise that their production significantly contributes to total household consumption (block I9), if considered employed according to the 13th ICLS (ILO, 2013b). This broad definition is sufficient to capture all possible informal work in the forest sector, such as seasonal loggers who are not bound by any written contract, wood fuel collectors for household subsistence or micro forest-related enterprises.

Table A1. Building-block approach to describe formal and informal employment

PRODUCTION UNITS	EMPLOYMENT STATUS									
	OWN-ACCOUNT WORKERS		EMPLOYERS		FAMILY WORKERS	EMPLOYEES		MEMBERS OF PRODUCERS' COOPERATIVES	
	INFORMAL	FORMAL	INFORMAL	FORMAL	INFORMAL	INFORMAL	FORMAL	INFORMAL	FORMAL
Formal sector enterprises		F1		F2	I1	I2	F3		F4
Informal sector enterprises	I3		I4		I5	I6	I7	I8	
Household	I9					I10	F5		

Source: Adapted from (ILO, 2013b).

Notes: F and I denote formal and informal employment, respectively. The grey shading indicates that blocks refer to informal employment.

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